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ABSTRACT

The relationship between performance on a core exam and various academic and background indicators among Georgia State University Master of Science in Urban Life graduate students was studied. Performance on the core examination was studied during 1971-79 to determine: (1) the relationship between core exam performance and core course graduates; (2) whether core exam scores can indicate scholastic potential; (3) differences by race and sex on core exam scores; and (4) whether core exam outcomes can be accurately predicted and used to advise prospective examinees. The statistics core exam section was found to be the section with the highest failure rate and was also the best indicator of final score outcomes. The history core exam was the second best predictor of performance. Graduate Record Examination scores were generally the best predictor of core exam section scores, followed by grades in core courses. There was trend indicating that the longer one was in the program before taking the core exam, the lower the section and final scores. Over time, the section failure rates have been both widely divergent, and also convergent. It is concluded that the core exam reasonably reflects the scholastic abilities of the Master of Science in Urban Life graduate students. References are included, as are graphical representations of the findings. (SW)

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EXPLORATORY STATISTICAL ANALYSIS OF THE CORE EXAM FOR MASTERS OF SCIENCE IN THE URBAN LIFE DEGREE PROGRAM

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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ABSTRACT

This research investigated the empirical association of core exam performance with various academic and background indicators among Master of Science in Urban Life graduate students. Questions concerning the rationale or external validity of the core exam were not within the scope of this empirical research. The major findings of this study were that:

1) The Statistics Core Exam Section was the section with the highest failure rate and was also the best indicator of Final Score outcomes. The Statistics Exam Score was most strongly associated with grades in Math 796 and 795 (Applied Statistics II and I) and with GRE Verbal and Quantitative scores. Additionally, performance on the Statistics Section was most predictable.

2) The History Core Exam Section was the second in predictability of performance. It was possible to achieve a high level of prediction of failure on this section.

3) GRE scores were generally the best predictor of Core Exam Section Scores, followed by grades in Core courses.

4) Minority students tended to make slightly lower scores on the History, Economics and Statistics sections even after controlling for past performance. However, minorities as a group made slightly higher Final Core Exam Scores after controlling for performance on the individual Core Exam Sections Scores.

5) There was a trend in which the longer in the program before taking the core exam, the lower the section and final scores.

6) Overtime, the section failure rates have been both widely divergent, and also convergent. Within the wide range of variability of failure rates there has been an overall, underlying upward trend.

It can be said that the core exam reasonably reflects the scholastic abilities of the Master of Science in Urban Life graduate students.

EXPLORATORY STATISTICAL ANALYSIS OF THE CORE EXAM FOR THE MASTER OF SCIENCE IN URBAN LIFE DEGREE PROGRAM

INTRODUCTION

The core exam component of the Master of Science in Urban Life degree program was instituted by the College of Urban Life as an exit type examination in 1970. This exam currently encompasses the graduate level core courses of Urban Political Behavior, (UL 810), Urban History (UL 820), The Urban Complex (UL 830), Economics of Urban Problems (UL 840), and Applied Statistics II (Math 796). The graduate student must successfully pass the Core Examination after having completed the core courses, or their equivalent as required for the Master of Science degree.

The purpose of this study is to investigate student performance on the Core Examination between 1971 and 1979 by analyzing the relationship between core exam scores and core course grades, controlling for academic potential and background characteristics of Urban Life graduate students. This research is an empirical analysis of performance on the core examination. It is not within the scope of this research to probe the scholastic or conceptual rationale of the core course procedure. Rather, this study is limited to investigation of performance indicators on the core itself. This study aims to answer the following questions:

1) What is the relationship between core exam performance and core course grades?

2) Are core exam scores associated with indicators of scholastic potential?

3) Do the core exam scores indicate differential performance by race and sex?

4) Can core exam outcomes be predicted accurately enough to be used to advise prospective examinees as to their chances of success and/or need for remedial efforts?

It is hoped that this study can be used as input to academic policy and procedural decisions.

PREVIOUS LITERATURE

The GRE has been used for several decades for selection, placement, and guidance in graduate degree programs. In a review article Thacker and Williams (1974) criticized the GRE as a predictor of graduate success. They indicated that reported correlations between the GRE and criterions of success were either not statistically significant, or were "low enough to raise serious doubts about the validity and the usefulness of the GRE in identifying potential successful graduate students" (p. 940).

The question of selecting a criterion variable has been widely debated in the consideration of academic prediction. Measurements of criterions of success include faculty ratings of students (Robertson and Nielsen, 1961; King and Besco, 1960), performance on comprehensive exams (Law, 1960), and program completion (Lin and Humphreys, 1977; Williams, Harlow, and Gab, 1970). Graduate course GPA's grades have frequently been used as the criterion.

Faculty ratings have been tested as a criterion variable in studies by Robertson and Nielsen (1961) and King and Besco (1960). The former study found no significant correlation between either GRE-Q or GRE-V, and the latter, a significance only between GRE-V and success as predicted by faculty ratings.

Williams, Harlow, and Gab (1970) tested the prognostic value of GRE scores when used with graduation as the criterion of success. The correlation coefficient of this criterion when compared to criteria used in other studies showed the greatest value of any predictor (Thacker and Williams, 1974). On the contrary, Nagi (1975) found that the GRE failed to differentiate those students who completed a doctoral program in Education from those who did not. Borg (1963) attempted to establish a cut off score, but found that it eliminated more successful candidates than unsuccessful candidates. Law (1960) found correlations between GRE-V and GRE-Q, and the criterion of performance on doctoral comprehensive exams to be significant.

The use of grades as a criterion of success has been widely employed in GRE predictive validity studies. Problems with using grades as the criterion variable include questions of reliability and variability. Typically, the use of grades has implied overall GPA. In some programs, however, as much as 3/4 of all grades have been A's. Results of such variable sets have been short, or restricted range measures (Dole and Baggaley, 1979). On the other hand, the heterogeneous nature of graduate programs suggests a need to disaggregate to the program level, and possibly to the individual course level. Madaus and Walsh (1965) noted that "separation of samples by department yielded higher correlations than did the use of total heterogeneous samples." The work of Goldman and Slaughter (1976) implied that single class grades can be more accurately predicted than overall GPA. Goldman and Slaughter argue that the GPA is often a less reliable indicator of performance than is an individual course grade.

This apparent contradiction, that repeated measure increase reliability, is explained in light of the fact that the courses making up the GPA often have differing grading standards. This often results in low correlations among various course grades. Such rationale would support Goldman and Slaughter's findings that individual course grades are more predictable than GPA's. The general form of their argument is that within course grades are more reliable than between course grades.

Results of tests of the validity of GRE as a predictor using GPA as the criterion of success have proven to be consistent. Thacker and Williams (1974) found correlations between GRE and graduate GPA to be either not significant, or so low that they were inefficient in predictive power. Humphreys and Taber (1973) found GRE's to have their highest and only significant correlation with freshman year grades. Herbert and Holmes (1979) found GRE-Q to be non-predictive, and GRE-V to be potentially predictive of graduate school success defined by GPA. And finally, Camp and Clawson (1979) found a low correlation between GRE-Q and GPA which suggested little predictive value. Correlation of .26 between GRE-V and GPA indicated some "guarded predictive validity." The Graduate Record Examination Board at the Educational Testing Service is currently pursuing a research program on the predictive validity of the GRE across many institutions. The standard criteria will be first year graduate GPA (GRE Board, 1979).

METHODS

The approach employed in this study was a careful data analysis looking for relationships and associations that were indicative of performance on the core exam. Both tabular and graphic presentations are used.

The Core Exam is scored on the basis of a score for each substantive area (i.e. political science, history, sociology, economics and statistics), on a scale of high pass, pass, low pass or fail. These scores are combined to determine a final outcome of pass, low pass, or fail. The statistical component, added in 1976, is scored on a numerical basis from 0-100, which is also expressed on the high pass to fail scale. A refinement of the scoring system has been developed to allow such scores as low pass/fail, which indicates a score between these two scores. If a student's overall performance is marginally between low pass and fail, a faculty committee reviews all sections and makes the final decision.

This analysis used both verbal and quantitative Graduate Record Examination (GRE) scores as measures of potential academic performance. As with any pencil and paper multiple choice test, the GRE is but an indicator of academic potential, and not a final arbiter. Numerous studies have shown that the GRE is moderately associated with graduate performance including the Masters in Urban Life program at GSU (see Prather and Heery, 1979). Typically, correlations in the .3 to .5 range have been reported as validating the predictive ability of the GRE. Generally, low GRE scores are more predictive of low performance than high GRE's are of superior performance. GRE's have been shown to predict performance for both minority and non-minority students.

Statistical techniques used included cross classification of the categorical data (scores and grades), distributions by categories (interval level scores), and scatter plots (interval with interval). When interval data were related to categorical data presentation, box-and-whisker plots

were used. In the box-and-whisker plot the box contains the middle 50% of the distribution, i.e. second and third quartiles. The box is divided by the median - the point where 50% of the scores are above or below. The whiskers extending above and below the box represent the range of the top 25% and the bottom 25% of the scores. Correlation coefficients were also reported for both ordinal and/or interval associations because correlations are traditionally used with test score data. The reader should be aware that these correlation coefficients must be interpreted with caution. Whenever possible the relationship between two variables was displayed graphically in this report to aid the discovery of nonlinear or other amorphous relationships.

To predict performance on the Core Examination, a specialized form of the linear model called discriminant analysis was employed. Discriminant analysis allows multiple indicators such as grades, scores, and the like, to predict core exam performance. Additionally, another form of the linear model, called multiple regression analysis, was used to determine the relative weights of the predictor variables' association with core exam scores.

FINDINGS

The findings section presents the analysis of the final core exam outcome scores with various predictors, followed by individual sections for each component of the core exam.

Core Exam Final Outcome Scores

The association of the five individual sections with the final score is presented in Exhibit 1. This Exhibit shows that those students who

EXHIBIT 1

CROSS-CLASSIFICATIONS OF CORE SECTIONS WITH FINAL SCORE

	FINAL SCORE				
	PASS %	LOW PASS %	FAIL %	TOTAL %	
POLITICAL SCIENCE					
High Pass	10	8	0	7	
Pass	58	25	4	39	
Low Pass	23	40	29	27	r=.60
Low Pass/Fail		2	1	1	
Fail	9	26	66	27	
N	184	53	83	320	
HISTORY					
High Pass	17	0	1	10	
High Pass/Pass	1	2	0	1	
Pass	47	33	12	36	
Pass/Low Pass	2	2	0	1	r=.58
Low Pass	28	50	24	30	
Fail	5	13	63	21	
N	184	54	83	321	
SOCIOLOGY					
High Pass	9			6	
Pass	47	24	15	35	
Low Pass	32	41	24	31	r=.50
Low Pass/Fail	0	4	0	1	
Fail	11	32	61	28	
N	184	54	83	321	
ECONOMICS					
High Pass	4	0	0	2	
High Pass/Pass	2	0	0	1	
Pass	30	13	5	21	
Pass/Low Pass	7	6	4	6	r=.48
Low Pass	43	59	33	43	
Low Pass/Fail	6	13	8	8	
Fail	8	9	51	19	
N	184	54	83	321	
STATISTICS					
High Pass	36	0	0	18	
Pass	32	13	14	20	
Low Pass	15	27	15	17	r=.64
Fail	17	60	78	45	
N	53	15	40	108	

achieve high pass in any one of the sections passes the total examination. The only exception to this is one student who had a high pass in the history section, but an overall fail. On the other hand, the failure in one section is a strong indicator of an overall fail score. Of those who failed the total examination, 66% failed the Political Science section, 63% the History section, 61% the Sociology section, 51% the Economics section, and 78% the Statistics section. A similar pattern is shown for the correlation coefficients between final score and section scores with a correlation of .60 for the Political Science section, .58 for History, .50 for Sociology, .40 for Economics, and .64 for Statistics. For those who achieved a final score of pass, it is shown that only 9% failed the Political Science section, 5% failed History, 11% failed Sociology, 8% failed Economics, and 17% failed Statistics. An even more telling indicator of final outcome concerns the low pass group, where 26% of these students failed the Political Science section, 13% History, 32% Sociology, 9% Economics, and 60% Statistics. It can be concluded that performance on the Statistics section of the examination is a strong indicator of overall performance, with Political Science and History being slightly less predictive, followed by Sociology and Economics. The intercorrelations of the core exam section scores with the final outcome scores are presented in Exhibit 2. The strongest intercorrelation is between Political Science and History exam sections (r=.41) ranging to a low correlation of .19 between the Political Science and Statistics section.

As a measure of academic potential, GRE scores are plotted with final core exam outcomes in Exhibit 3. The association between GRE and final

EXHIBIT 2

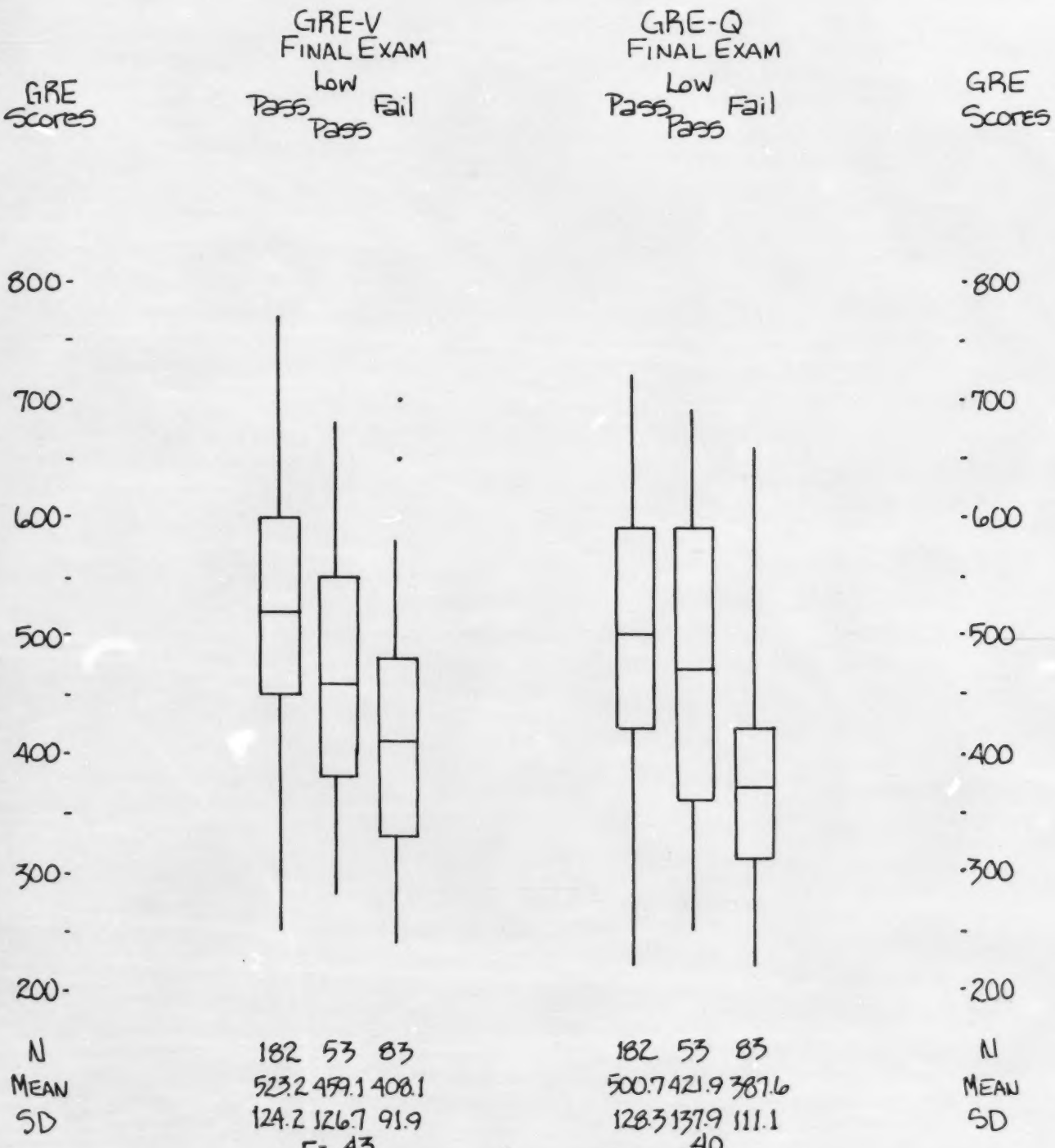
CORRELATIONS AMONG CORE EXAM SECTION SCORES AND FINAL SCORE

SECTION SCORES	POLITICAL SCIENCE SECTION	HISTORY SECTION	SOCIOLOGY SECTION	ECONOMICS SECTION	STATISTICS SECTION	FINAL
POLITICAL SCIENCE SECTION		321	321	321	109	321
HISTORY SECTION	.41		322	322	109	322
SOCIOLOGY SECTION	.36	.33		322	109	322
ECONOMICS SECTION	.29	.38	.34		109	322
STATISTICS SECTION	.19	.36	.25	.32		109
FINAL	.60	.58	.50	.48	.64	

Note: N's are above diagonal.

EXHIBIT 3

PLOTS OF FINAL CORE EXAM GRADE WITH GRE VERBAL AND QUANTITATIVE SCORES FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS



core exam score is slightly stronger for GRE Verbal (r=.43) than for GRE quantitative (r=.40). The Exhibit shows that 75% of those who had a pass score have higher GRE quantitative scores than 75% of those who have fail scores. Thus GRE scores are clearly an important predictive indicator of performance on the core examination.

In Exhibits 4 and 5 the scatter plots of the Statistics Section numerical scores with the GRE are shown. These plots show that the GRE Quantitative score has a stronger association (r=.49) than the Verbal (r=.32). For example, a 200-point difference in GRE quantitative scores predicts a 16-point difference in numerical scores on the Statistics Section.

A discriminant analysis, performed using the individual section scores along with the year the examination was taken and the number of attempts at passing the examination, is used to predict final outcome scores. Technically, the problem of only 1/3 of this population having taken the Statistical Section is dealt with by substitution of the mean score for missing scores, along with dummy variables to indicate the presence of missing data (for details on this procedure see Cohen and Cohen, 1973). The results of the discriminant analysis shown in Exhibit 6 indicate that of those who actually failed the core exam, 88% would have been predicted to fail, while 12% of the fail group would have been predicted to be in the low pass group. Of those who actually were in the pass group only 3 would have been predicted to fail, while 78% would have been predicted to be passes. The ability to predict the low pass group is 60%, with 19% having been predicted to fail. This is undoubtedly illustrative of the intangible factor in deter-

EXHIBIT 4

SCATTER PLOT OF STATISTICS CORE EXAM SECTION GRADE WITH GRE VERBAL SCORE FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS

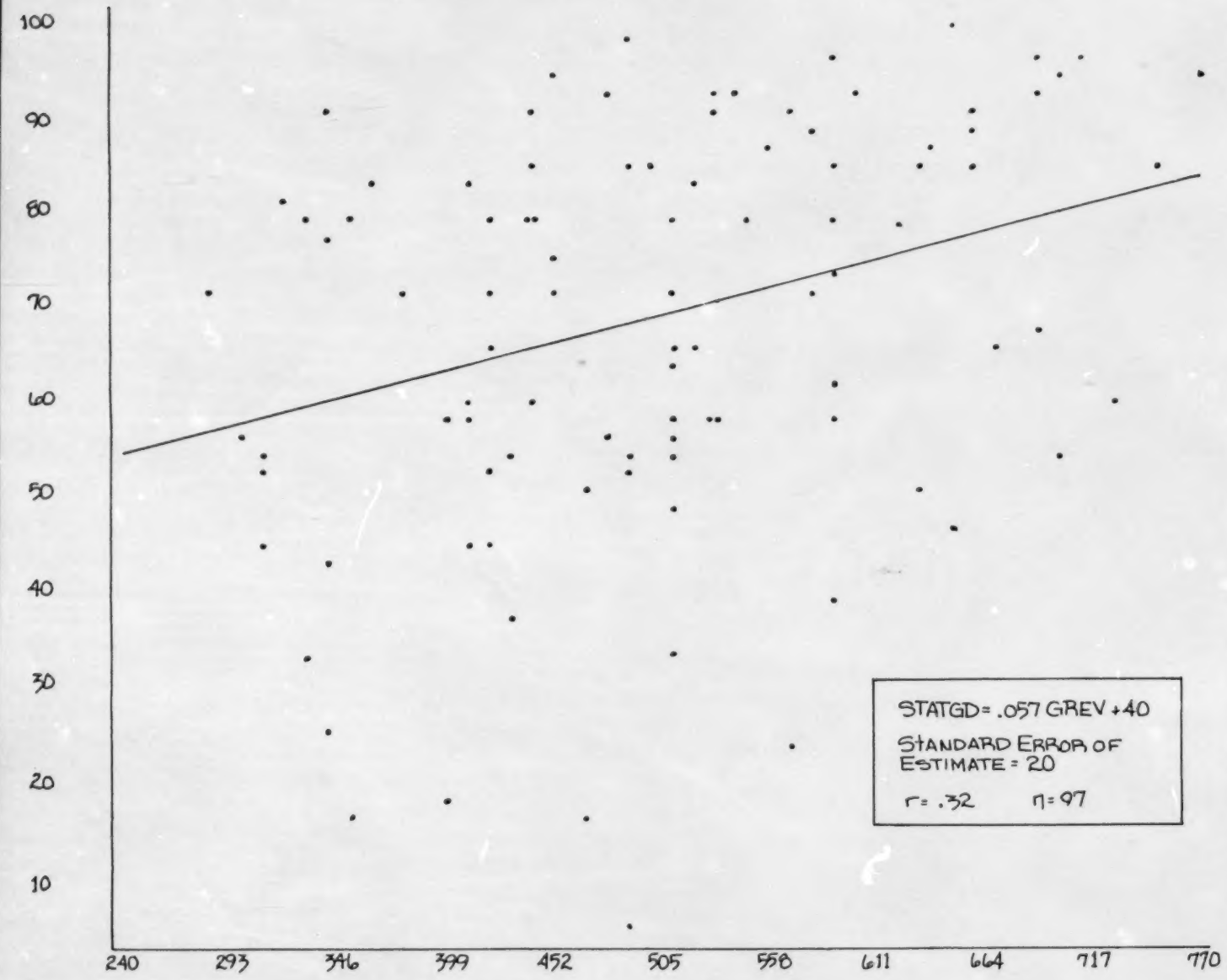


EXHIBIT 5

SCATTER PLOT OF STATISTICS CORE EXAM SECTION GRADE WITH GRE QUANTITATIVE SCORE FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS.

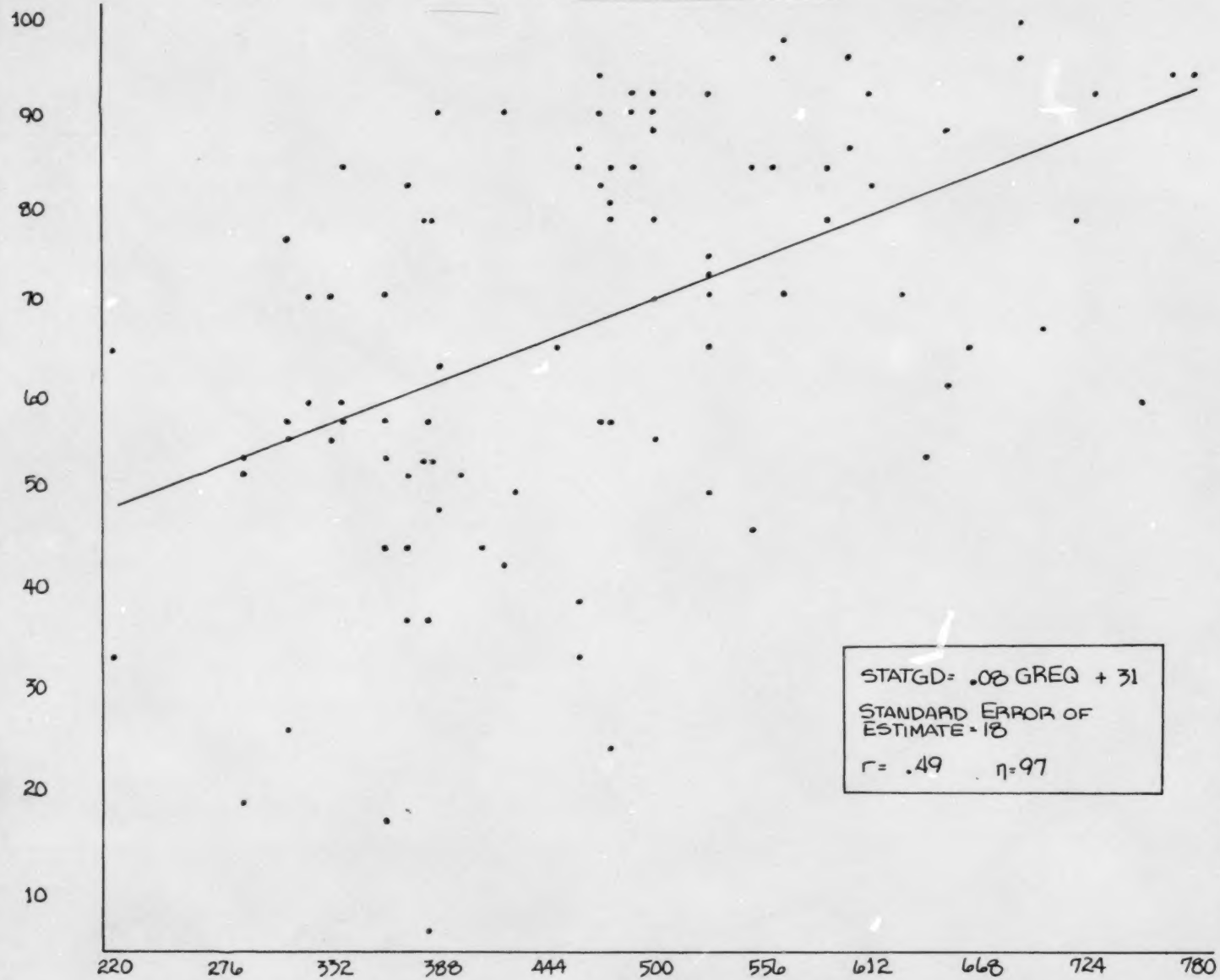


EXHIBIT 6

DISCRIMINANT ANALYSIS FOR PREDICTED FINAL CORE EXAM SCORE

ACTUAL FINAL GRADE	PREDICTED FINAL CORE EXAM SCORE: PASS %	LOW PASS %	FAIL %	N
PASS	[78]	18	3	185
LOW PASS	21	[60]	19	53
FAIL	0	12	[88]	83

PERCENT CORRECTLY CLASSIFIED = 78%

VARIABLES INCLUDED IN DISCRIMINANT ANALYSIS:

POLITICAL SCIENCE SCORES
HISTORY SCORES
SOCIOLOGY SCORES
ECONOMICS SCORES
STATISTICS SCORES
STATISTICS NUMERICAL SCORE
MISSING DATA: STATISTICS
STATISTICS NUMERICAL SCORE
YEAR TOOK EXAM
NUMBER OF ATTEMPTS

mining final outcome. Overall, 78% of the sample was correctly classified for the final exam score.

In order to determine the weighting of the predictor variables with the final outcome score, a multiple regression was performed (see Exhibit 7). This exhibit shows the unstandardized regression coefficient along with the standardized regression coefficient (B). Using the regression coefficients, a similar pattern of strength of relationship to that previously discussed was found. The strongest indicator of final outcome is the Statistics Section score, followed by Political Science, History, Economics, and Sociology. To emphasize the weight of the Statistics section it can be noted that those who did not take the Statistics section as a group made higher final outcome scores. Three indicators of possible discrimination of the core exam are included - sex, race, and age. Regression coefficients of these variables show that males and/or older students make slightly lower scores, but that minority student make slightly higher scores, when controlling for academic background factors.

Political Science Core Exam Section

For those students who had taken Urban Political Behavior (UL 810) and the Political Science section of the core exam, the association is found to be weak (r=.18) (Exhibit 8). Of those students who made A's in UL 810 17% failed the Political Science section of the core. Of those who made B's, 35% failed. There was a tendency for the 'A' students to make higher core exam scores.

In Exhibit 9 the relationship of GRE scores and Political Science scores and grades is presented. These plots show a moderately strong

EXHIBIT 7
MULTIPLE REGRESSION OF FINAL CORE EXAM SCORE

VARIABLE	REGRESSION COEFFICIENT	STANDARD ERROR OF COEFFICIENT	β
POLITICAL SCIENCE	.30	.04	.33
HISTORY	.22	.04	.24
SOCIOLOGY	.16	.04	.17
ECONOMICS	.17	.05	.15
STATISTICS	.41	.09	.35
STATISTICS SCORE	-.01	.01	-.07
GRE VERBAL	-.0001	.0008	-.01
GRE QUANTITATIVE	.0002	.0008	.02
# ATTEMPTS	-.03	.20	-.01
YEAR TOOK EXAM	-.10	.06	-.11
MALE	-.08	.13	-.02
MINORITY	.41	.18	.12
AGE	-.003	.01	-.01
MISSING DATA:			
STATISTICS SECTION	.17	.34	.05
STATISTICS SCORE	.20	.35	.05
CONSTANT	7.91		

$R^2 = .67$
$\bar{R}^2$ (ADJUSTED) = .65
S.E.E. = 1.02
$n = 312$

EXHIBIT 8

RELATIONSHIP of POLITICAL SCIENCE CORE EXAM SECTION GRADE with UL 810 (URBAN POLITICAL BEHAVIOR) FINAL COURSE GRADE for MASTERS of SCIENCE in URBAN LIFE GRADUATE STUDENTS.

	POLITICAL SCIENCE COURSE GRADE				
POLITICAL SCIENCE CORE EXAM SCORE	A %	B %	C %	W %	Total %
High Pass	10	4			6
Pass	46	28	70	45	38
Low Pass	26	32	10	33	28
Low Pass/Fail	1	1		11	1
Fail	17	35	20	11	26
Total N	93	120	10	9	232

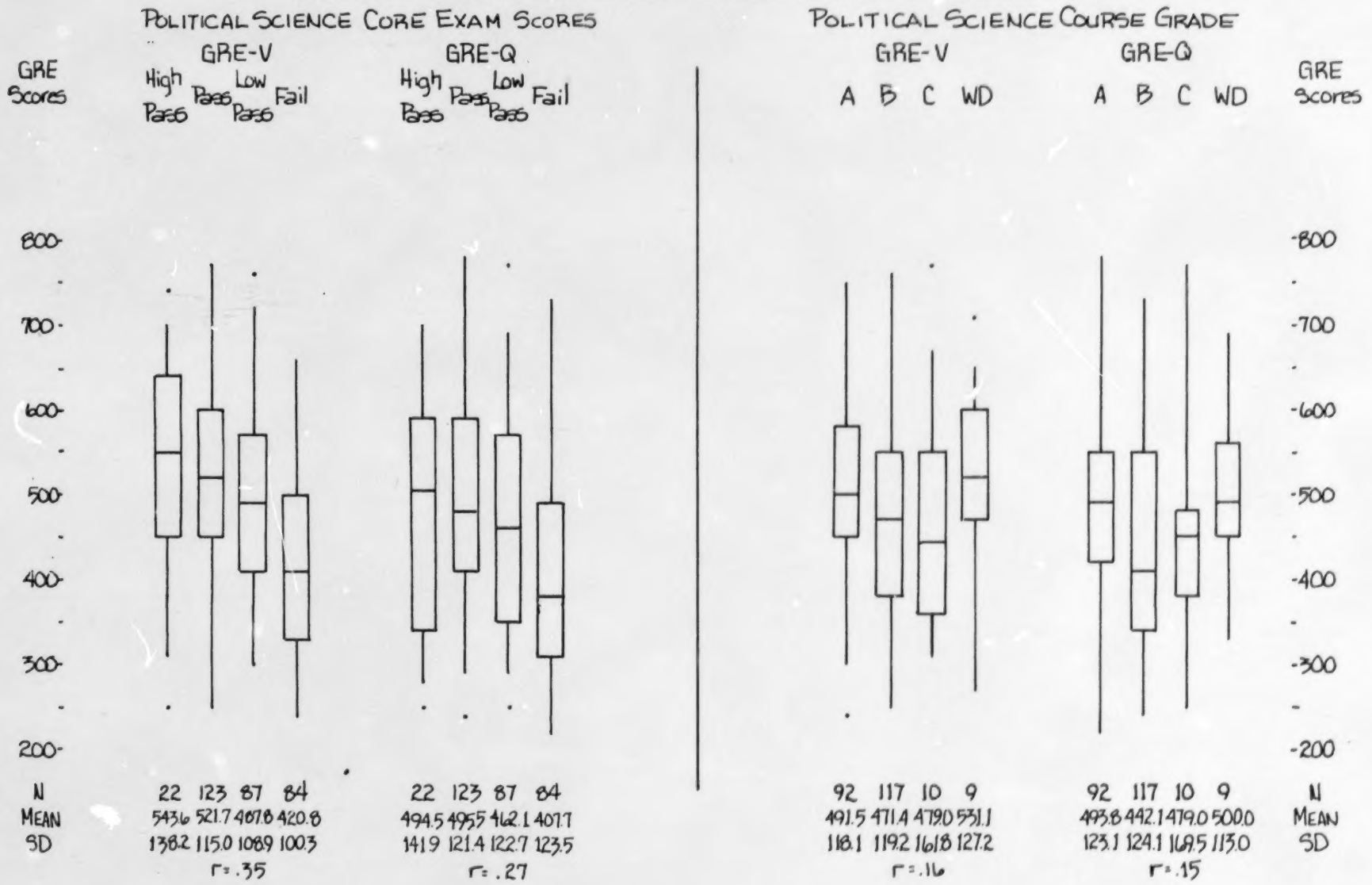
$\chi^2 = 27.6$ df. 12 p = .006

Uncertainty coefficient = .06

r = .18

EXHIBIT 9

PLOTS OF CORE EXAM POLITICAL SCIENCE SECTION AND UL810 (URBAN POLITICAL BEHAVIOR) FINAL COURSE GRADES WITH GRE VERBAL AND QUANTITATIVE SCORES FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS



correlation (.35) between GRE Verbal score and Political Science core exam. Note that the grades in UL 810 for these students have a lower association (r=.16).

The prediction of Political Science Core Exam score using grades and GRE's is given in Exhibit 10. This shows that of those who failed the Political Science exam section, 56% would have been predicted to fail. Overall, 27% were correctly classified.

History Core Exam Section

The Urban History Course (UL 820) grades and the History core exam section are cross-classified in Exhibit 11 and show a correlation of .33. Only 4% of those receiving A's in UL 820 failed the History section. Also, in Exhibit 12, the association between GRE's and the History section are moderately stronger (r=.42 with the GRE Verbal). The association of History course grades and GRE scores is a correlation of .40 for GRE verbal. The predication of the History exam section is given in Exhibit 13. Here 71% of those who failed were predicted to fail based upon History grade and GRE's. It can be concluded that GRE scores are predictive of grades in UL 820, and that the History course grade is predictive of performance on the History core exam section.

Sociology Core Exam Section

In Exhibit 14 the relationship of Sociology core exam scores with Sociology course grades (UL 830) is shown. A correlation of .27 is found. Of those making an 'A' in UL 830, 18% failed the core exam section, as compared to 32% of those making B's.

EXHIBIT 10

DISCRIMINANT ANALYSIS FOR PREDICTED CORE EXAM SCORE IN THE POLITICAL SCIENCE SECTION USING UL810 (URBAN POLITICAL BEHAVIOR) GRADE AND GRE VERBAL AND QUANTITATIVE SCORES

ACTUAL POLITICAL SCIENCE CORE EXAM SCORE	PREDICTED POLITICAL SCIENCE CORE EXAM SCORE					
	HIGH PASS %	PASS %	LOW PASS %	LOW PASS/ FAIL %	FAIL %	N
HIGH PASS	[43]	7	7	29	14	14
PASS	37	[18]	0	19	25	83
LOW PASS	21	14	[8]	13	44	63
LOW PASS/ FAIL	0	0	50	[50]	0	2
FAIL	7	16	9	12	[56]	57

PERCENT CASES CORRECTLY CLASSIFIED = 27%

EXHIBIT 11

RELATIONSHIP of HISTORY CORE EXAM SECTION GRADE with UL 820 (URBAN HISTORY) FINAL COURSE GRADE for MASTERS of SCIENCE in URBAN LIFE GRADUATE STUDENTS.

HISTORY CORE EXAM SCORE	HISTORY COURSE GRADE A %	B %	C %	F %	W %	Total %
High Pass	26	5				10
High Pass/Pass	1	1				1
Pass	43	27	18	50	50	32
Pass/Low Pass		2				1
Low Pass	26	34	55	50	25	33
Fail	4	31	27		25	22
Total N	70	151	11	2	8	242

$\chi^2 = 48.8$ df = 20 p = .0003

Uncertainty coefficient = .09

r = .33

EXHIBIT 12

PLOTS OF CORE EXAM HISTORY SECTION AND LIL 820(URBAN HISTORY) FINAL COURSE GRADES WITH GRE VERBAL AND QUANTITATIVE SCORES FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS

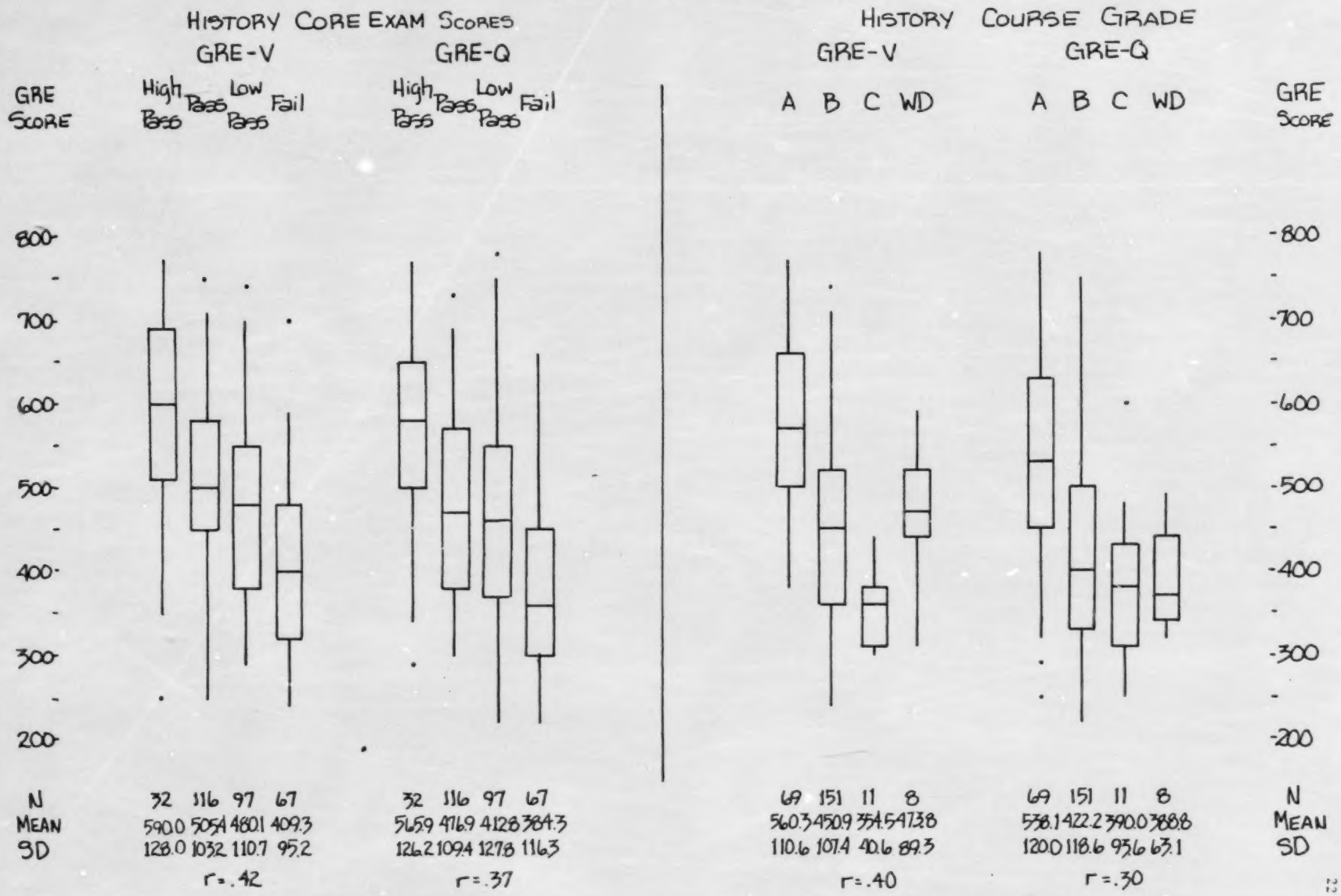


EXHIBIT 13

DISCRIMINANT ANALYSIS FOR PREDICTED CORE EXAM SCORE IN THE HISTORY SECTION USING UL 820 (URBAN HISTORY) GRADE AND GRE VERBAL AND QUANTITATIVE SCORES

	PREDICTED HISTORY CORE EXAM SCORE						
ACTUAL HISTORY CORE EXAM SCORE	HIGH PASS %	HIGH PASS/ PASS %	PASS %	PASS/ LOW PASS %	LOW PASS %	FAIL %	N
HIGH PASS	[54]	13	17	4	8	4	24
HIGH PASS/PASS	33	[33]	0	33	0	0	3
PASS	22	16	[15]	16	15	16	74
PASS/LOW PASS	0	0	0	[0]	67	33	3
LOW PASS	14	13	8	13	[17]	35	77
FAIL	2	6	0	8	14	[71]	52

PERCENT CORRECTLY CLASSIFIED = 32%

EXHIBIT 14

RELATIONSHIP of SOCIOLOGY CORE EXAM SECTION GRADE with UL 830 (THE URBAN COMPLEX) FINAL COURSE GRADE for MASTERS of SCIENCE in URBAN LIFE GRADUATE STUDENTS

	SOCIOLOGY COURSE GRADE					
SOCIOLOGY CORE EXAM SCORES	A %	B %	C %	I %	W %	Total %
High Pass	11	2				7
Pass	39	29	33	100	33	35
Low Pass	32	36			67	33
Low Pass/Fail		1				1
Fail	18	32	67			25
Total N	107	92	3	1	3	195

$\chi^2 = 25.0$ df = 16 p = .07

Uncertainty Coefficient = .07

r = .27

GRE Verbal scores have a correlation of .32 with the Sociology core exam score, as compared to an correlation equal to .25 in the Sociology course grade (Exhibit 15).

The discriminant analysis given in Exhibit 16 shows that 54% of the "fails" were correctly predicted and that 23% overall were correctly predicted.

Economics Core Exam Section

The association of the Economics core exam section with Economics of Urban Problems (UL 840) is shown in Exhibit 17. A relatively weak correlation of .22 is found. Of those making A's in UL 840, 9% failed the core exam section, compared to 22% of the B's and 37% of the C's.

In Exhibit 18 the association with GRE scores are plotted. A relatively weak correlation of .32 is found between GRE Verbal and the Economic section of the exam. On the other hand, the GRE scores were strongly predictive of Economics course grade. The correlation of GRE verbal and course grade is .40 and of quantitative and course grade, .50. The anomalous situation here is that GRE's are relatively strongly predictive of course grade, but course grade and GRE scores are less predictive of core performance.

In Exhibit 19 the discriminant analysis to predict the Economics section of the exam was correct 21% of the time. Of those failing, 4% were predicted correctly.

Statistics Core Exam Section

In Exhibit 20 a correlation of .42 is found between Math 796 (applied Statistics II) and the Statistics section of the core exam. This table

EXHIBIT 15

PLOTS OF CORE EXAM SOCIOLOGY SECTION AND UL 830 (THE URBAN COMPLEX) FINAL COURSE GRADES WITH GRE VERBAL AND QUANTITATIVE SCORES FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS

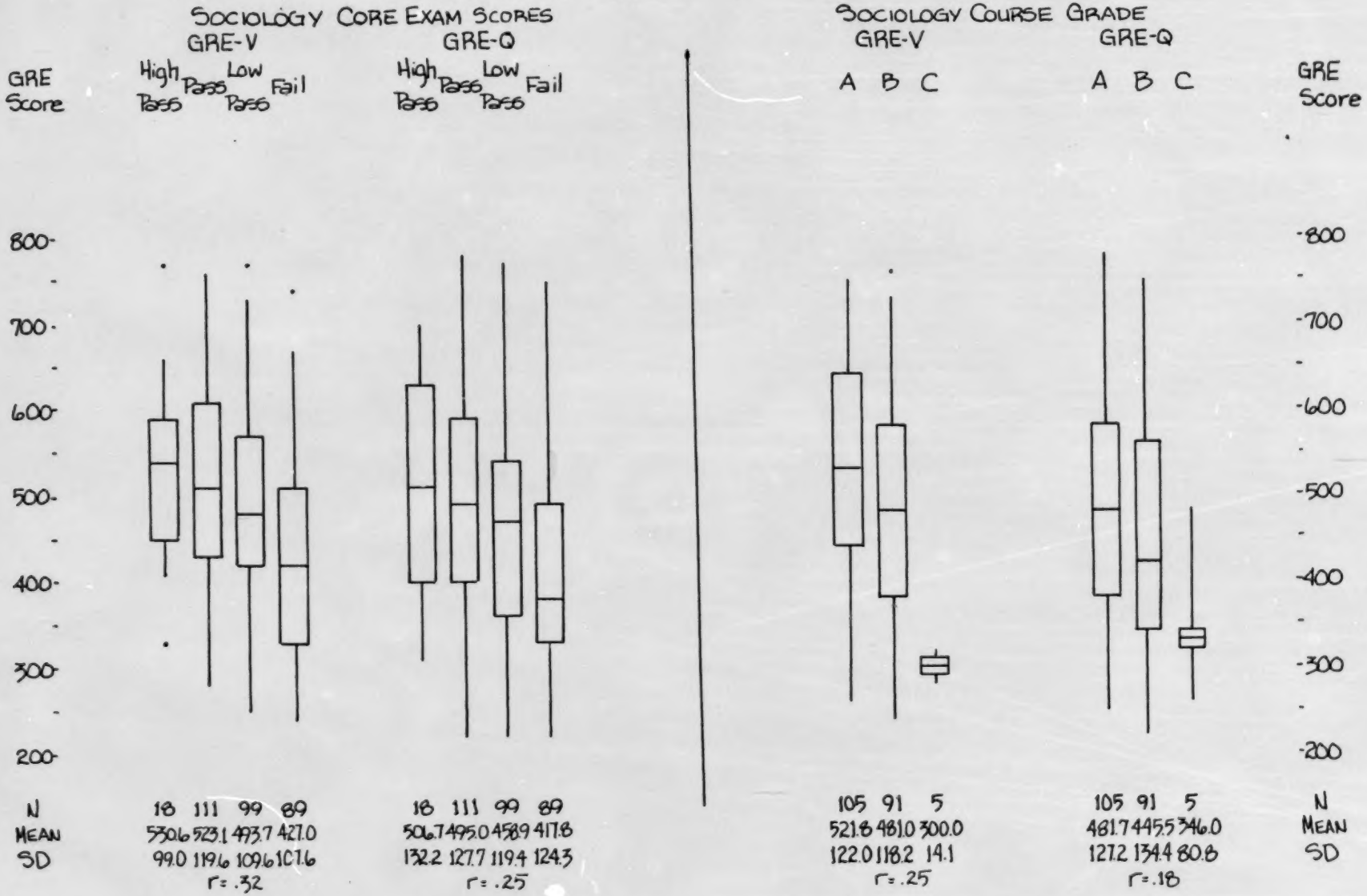


EXHIBIT 16

DISCRIMINANT ANALYSIS FOR PREDICTED CORE EXAM SCORE IN THE SOCIOLOGY SECTION USING UL 830 (THE URBAN COMPLEX) GRADE AND GRE VERBAL AND QUANTITATIVE SCORES

ACTUAL SOCIOLOGY CORE EXAM SCORE	PREDICTED SOCIOLOGY CORE EXAM SCORE					
	HIGH PASS %	PASS %	LOW PASS %	LOW PASS/ FAIL %	FAIL %	N
HIGH PASS	[86]	0	0	0	14	14
PASS	57	[1]	7	22	13	69
LOW PASS	48	2	[8]	22	22	65
LOW PASS/FAIL	0	0	0	[100]	0	1
FAIL	19	0	8	19	[54]	52

PERCENT CORRECTLY CLASSIFIED= 23%

EXHIBIT 17

RELATIONSHIP of ECONOMICS CORE EXAM SECTION GRADE with UL 840 (ECONOMICS of URBAN PROBLEMS) FINAL COURSE GRADE for MASTERS of SCIENCE in URBAN LIFE GRADUATE STUDENTS

	ECONOMICS COURSE GRADE						
ECONOMICS CORE EXAM SCORE	A %	B %	C %	I %	W %	US %	Total %
High Pass	4	2					3
High Pass/Pass	3						1
Pass	29	20	21				22
Pass/Low Pass	4	4			80		4
Low Pass	45	42	37				43
Low Pass/Fail	6	10	5		20	100	8
Fail	9	22	37	100			19
Total N	69	143	19	1	5	1	238

$\chi^2 = 36.2$ df = 30 p = .20

Uncertainty coefficient = .05

r = .22

EXHIBIT 18

PLOTS OF CORE EXAM ECONOMICS SECTION AND UL 840 (ECONOMICS OF URBAN PROBLEMS) FINAL COURSE GRADES WITH GRE VERBAL AND QUANTITATIVE SCORES FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS

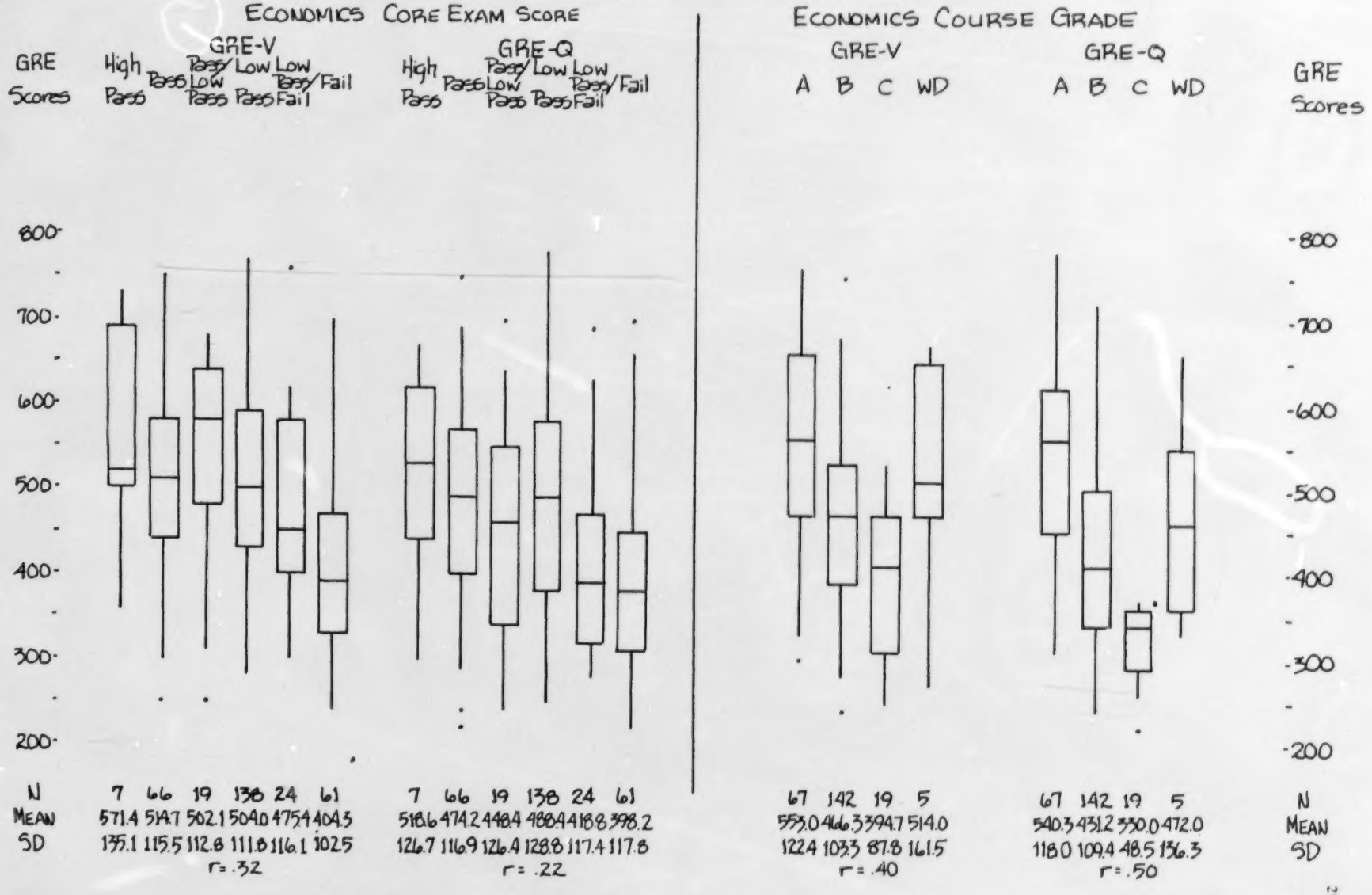


EXHIBIT 19

DISCRIMINANT ANALYSIS FOR PREDICTED CORE EXAM SCORE IN THE ECONOMICS SECTION USING UL840 (ECONOMICS OF URBAN PROBLEMS) GRADE AND GRE VERBAL AND QUANTITATIVE SCORES

ACTUAL ECONOMICS CORE EXAM SCORE	PREDICTED ECONOMICS CORE EXAM SCORE							
	High Pass %	High Pass/ Pass %	Pass %	Pass/ Low Pass %	Low Pass %	Low Pass/ Fail %	Fail %	N
High Pass	[33]	0	0	0	17	33	17	6
High Pass/ Pass	0	[100]	0	0	0	0	0	2
Pass	18	19	[10]	8	8	14	24	51
Pass/ Low Pass	22	11	22	[0]	22	22	0	9
Low Pass	15	20	7	5	[8]	19	25	98
Low Pass/ Fail	17	0	11	0	17	[22]	33	18
Fail	7	2	0	2	9	16	[64]	44

PERCENT CORRECTLY CLASSIFIED= 21%

EXHIBIT 20

RELATIONSHIP of STATISTICS CORE EXAM SECTION GRADE with MATH 796 (APPLIED STATISTICS II) FINAL COURSE GRADES for MASTERS of SCIENCE in URBAN LIFE GRADUATE STUDENTS.

	MATH 796 COURSE GRADES					
STATISTICS CORE EXAM SCORE	A %	B %	C %	F %	W %	Total %
High Pass	25	8			10	17
Pass	32				20	21
Low Pass	13	13	42		30	17
Fail	30	79	58	100	40	46
Total N	64	24	12	2	10	112

$\chi^2 = 31.6$ df = 12 p = .0003

Uncertainty coefficient = .15

r = .42

shows that 30% of the 'A' students fail the statistics section of the core exam, 79% of the 'B' students, 58% of the 'C' students, and 100% of the 'F' students (n=2). Additionally, 40% of those who withdrew failed.

The plots of GRE scores with section scores and grades show relatively strong correlations in the range of .44 to .46. This indicates that Statistics section scores are more predictable. This is born out by the discriminant analysis, where 47% of the students were correctly classified. It was found that 49% of those who failed would have been predicted to have failed. Of those students who took Math 796 but not the Math section of the core exam, 23% would have been predicted to have failed (Exhibits 21-22).

For those who took the optional course Math 795 (Applied Statistics I), the strongest correlation (.50) between grade and core exam section is found in Exhibit 23. Of those making A's in Math 795 only 12% failed, of the B's, 42% failed, and of C's, 74% failed.

In Exhibit 24 the association between GRE scores and Applied Statistics I grades are given. The correlation with the quantitative score is .50. The discriminant analysis given in Exhibit 25 shows that 71% of those who failed would have been predicted to fail. Overall, 53% were correctly classified.

The predictability of core section scores using grades and GRE scores shows that statistics I & II are the (Stat I-53%, Stat II-47%) most predictive followed by History (32%), Political Science (27%), Sociology (23%), and Economics (21%). This suggests that Math 795 is a key component in passing both the Statistics section of the core exam and the core exam itself.

EXHIBIT 21

PLOTS OF CORE EXAM STATISTICS SECTION AND MATH 796 (APPLIED STATISTICS II) FINAL COURSE GRADES WITH GRE VERBAL AND QUANTITATIVE SCORES FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS

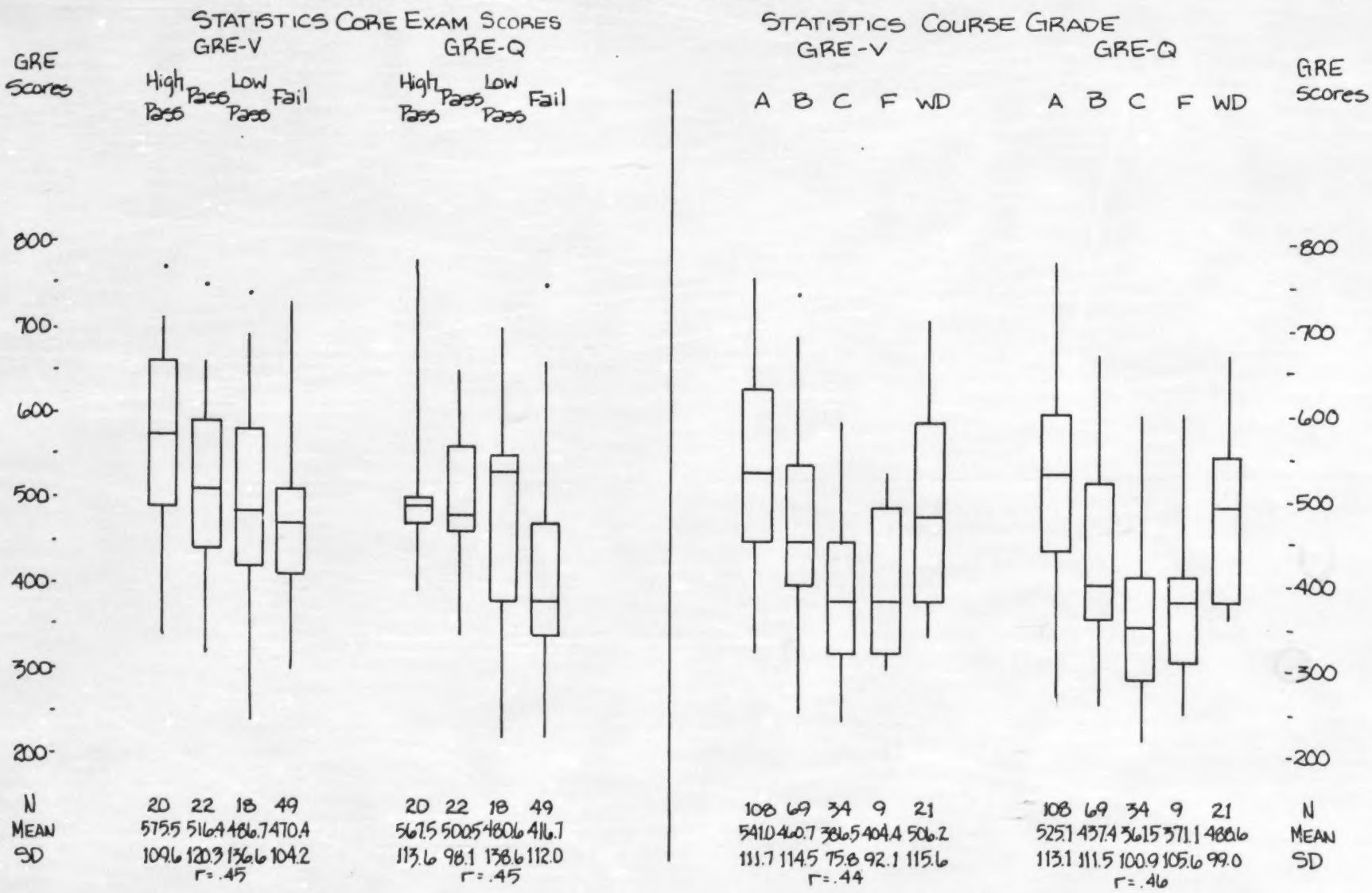


EXHIBIT 22

DISCRIMINANT ANALYSIS FOR PREDICTED CORE EXAM SCORE IN THE STATISTICS SECTION USING MATH 796 (APPLIED STATISTICS II) GRADE AND GRE VERBAL AND QUANTITATIVE SCORES

ACTUAL STATISTICS CORE EXAM SCORE	PREDICTED STATISTICS CORE EXAM SCORE				
	HIGH PASS %	PASS %	LOW PASS %	FAIL %	N
HIGH PASS	[56]	33	0	11	18
PASS	43	[52]	0	5	21
LOW PASS	31	19	[25]	25	16
FAIL	17	21	13	[49]	47

PERCENT CASES CORRECTLY CLASSIFIED = 47%

DID NOT TAKE STATISTICS SECTION	19	20	38	23	118

EXHIBIT 23

RELATIONSHIP of STATISTICS CORE EXAM SECTION GRADE with MATH 795 (APPLIED STATISTICS I) FINAL COURSE GRADE for MASTERS of SCIENCE in URBAN LIFE GRADUATE STUDENTS.

	MATH 795 COURSE GRADE							
STATISTICS CORE EXAM SCORE	A %	B %	C %	D %	F %	I %	US %	Total %
High Pass	38	13	0					15
Pass	35	26	13			33	100	24
Low Pass	15	19	13		50			17
Fail	12	42	74	100	50	67		44
Total N	26	31	24	1	6	3	1	92

$\chi^2 = 39.7$ df = 18 p = .002

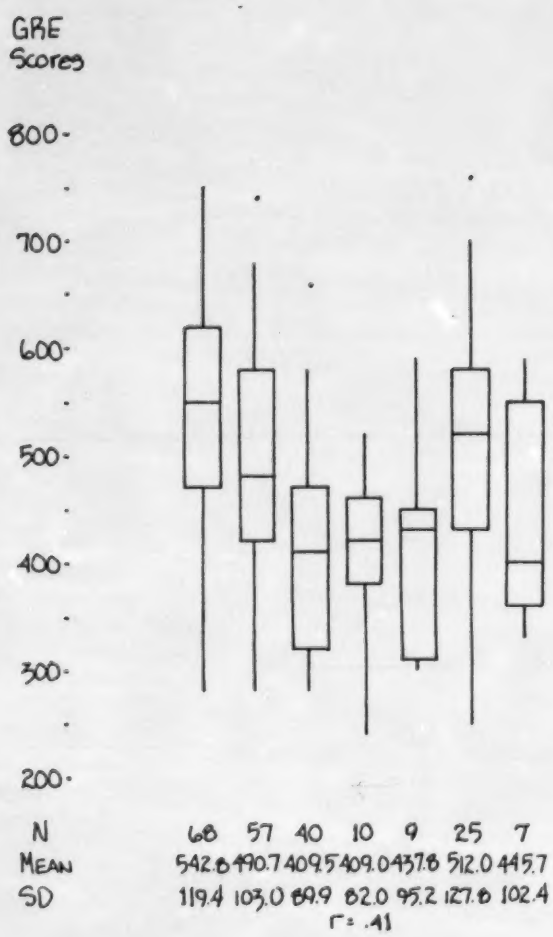
Uncertainty Coefficient = .19

r = .50

EXHIBIT 24

PLOTS OF MATH 795 (APPLIED STATISTICS I) FINAL COURSE GRADES WITH GRE VERBAL AND QUANTITATIVE SCORES FOR MASTERS OF SCIENCE IN URBAN LIFE GRADUATE STUDENTS

GRE-V



GRE-Q

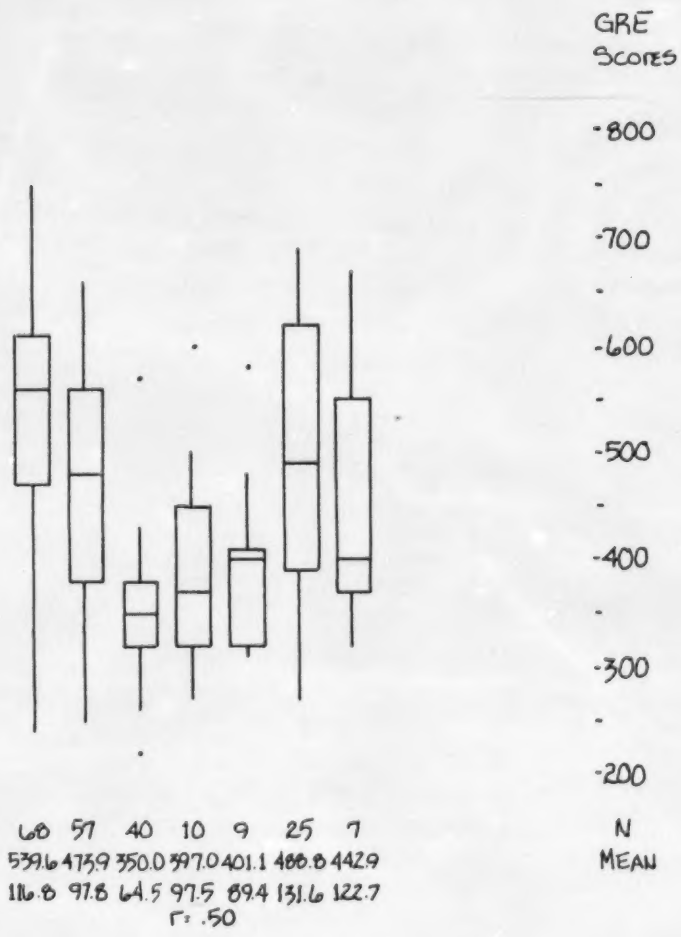


EXHIBIT 25

DISCRIMINANT ANALYSIS FOR PREDICTED CORE EXAM SCORE IN THE STATISTICS SECTION USING MATH 795 (APPLIED STATISTICS I) GRADE AND GRE VERBAL AND QUANTITATIVE SCORES

ACTUAL STATISTICS CORE EXAM GRADE	PREDICTED STATISTICS CORE EXAM SCORE				
	HIGH PASS %	PASS %	LOW PASS %	FAIL %	N
HIGH PASS	[71]	29	0	0	14
PASS	35	[35]	10	20	20
LOW PASS	25	25	[19]	31	16
FAIL	11	11	8	[71]	38

PERCENT CORRECTLY CLASSIFIED = 53%

DID NOT TAKE STATISTICS SECTION	30	35	8	27	88

Multiple Regressions of Core Sections by Course

In this final section each core course is related to the respective core exam section along with GRE's, age, race and sex. These six regressions are presented in Exhibit 26. They show that course grade is strongly predictive of section score, except for Economics. GRE verbal is strongly predictive of all except the Statistics section which is highly predictable using the quantitative score. History and Statistics show the highest levels of prediction followed by Political Science, Sociology, and Economics. Age is not generally indicative of performance except for Political Science and History, where it is slightly negative. Minority status is negatively associated with performance on the History, Economics and Statistics sections. It is positively associated with performance on Sociology; though it should be noted that the standard error on the minority variable is quite high.

In order to check for the extent to which the time lapse between enrollment in courses and taking the core exam is associated with core exam section scores, these two variables are cross-classified (Exhibit 27). This table shows that generally, the greater the time between courses and appropriate core exam sections, the greater the tendency to make slightly lower scores. This tendency is strongest for Economics and Sociology, followed by Statistics and Political Science. Time lapse between the history course and the exam show no association.

To further explore the effect of time lapse upon core exam performance, an analysis is shown using the number of years since entering the program before taking the core exam, with core exam scores. In Exhibit 28 these

EXHIBIT 26

MULTIPLE REGRESSIONS OF CORE SECTIONS BY COURSE

REGRESSION COEFFICIENTS	POLITICAL SCIENCE	HISTORY	SOCIOLOGY	ECONOMICS	STATISTICS I	STATISTICS II
COEFFICIENTS						
COURSE GRADE	.40	.46	.68	.20	.73	.71
GRE VERBAL	.005	.005	.005	.003	-.001	-.0006
GRE QUANTITATIVE	.001	.001	-.0004	.0004	.005	.004
AGE	-.07	-.04	.004	.002	.01	-.05
MINORITY	.06	-.53	.27	-.34	-.31	-.66
MALE	-.15	-.07	.08		-.48	
CONSTANT	1.14	.63	-1.62	1.04	-.60	.69
STANDARD ERROR COEFFICIENT						
COURSE GRADE	.20	.20	.23	.19	.25	.31
GRE VERBAL	.001	.001	.001	.001	.002	.003
GRE QUANTITATIVE	.001	.001	.001	.001	.004	.003
AGE	.02	.02	.02	.02	.04	.04
MINORITY	.34	.33	.38	.29	.70	.68
MALE	.25	.24	.26		-.10	
β						
COURSE GRADE	.13	.15	.20	.07	.35	.26
GRE VERBAL	.34	.29	.36	.22	-.06	-.03
GRE QUANTITATIVE	.08	.10	-.02	.04	.26	.23
AGE	-.22	-.10	.01	.01	.03	-.14
MINORITY	.01	-.14	.07	-.11	-.07	-.13
MALE	-.03	-.02	.02		.53	
R^2	.19	.28	.16	.14	.28	.25
$\bar{R}^2$ (ADJUSTED)	.17	.26	.14	.12	.23	.21
S.E.E.	1.68	1.62	1.71	1.42	2.00	2.09
n	215	230	196	225	87	100

EXHIBIT 27

CROSS-CLASSIFICATION OF NUMBER OF YEARS BETWEEN CORE COURSE AND CORE EXAM SECTION SCORE

	LESS ONE	1	2	3	4	5	6	7	8	TOTAL	
POLITICAL SCIENCE											
HIGH PASS	9	8	0	0	11	0	25	0	0	6	
PASS	38	39	46	28	44	29	0	50	0	38	
LOW PASS	32	28	27	28	11	29	75	0	0	28	r=-.09
LOW PASS/FAIL	0	0	0	0	11	0	0	50	100	1	
FAIL	21	25	27	44	22	43	0	0	0	26	GAMMA=-.12
N	47	103	41	18	9	7	4	2	1	232	
HISTORY											
HIGH PASS	3	13	8	10	0	14	20			11	
HIGH PASS/PASS	0	2	0	0	0	0	20			1	
PASS	26	32	53	24	0	14	20			32	r= .01
PASS/LOW PASS	3	2	0	0	0	0	0			1	
LOW PASS	39	29	32	33	43	57	40			33	GAMMA= .04
FAIL	29	22	8	33	57	14	0			22	
N	31	134	38	21	7	7	5			243	
SOCIOLOGY											
HIGH PASS	8	9	3	0	0	0	0	0		7	
PASS	35	35	49	18	25	0	25	0		34	r=-.22
LOW PASS	41	32	27	31	50	0	25	100		33	
LOW PASS/FAIL	0	0	3	0	0	0	0	0		1	GAMMA=-.20
FAIL	16	24	18	50	25	100	50	0		26	
N	49	98	33	16	4	5	4	1		210	
ECONOMICS											
HIGH PASS	5	2	0	0	0	0	0			3	
HIGH PASS/PASS	1	1	0	0	0	0	0			1	
PASS	31	22	19	8	17	0	0			23	r=-.24
PASS/LOW PASS	4	3	9	0	0	0	0			4	
LOW PASS	39	46	44	39	50	25	0			43	GAMMA=-.27
LOW PASS/FAIL	8	7	9	8	0	50	0			8	
FAIL	13	20	19	46	33	25	100			19	
N	78	101	32	13	6	4	1			239	
STATISTICS II											
HIGH PASS	15	23	6							17	
PASS	32	15	11							21	r=-.14
LOW PASS	12	19	22							17	
FAIL	42	43	61							46	GAMMA=-.17
N	41	53	18							112	
STATISTICS I											
HIGH PASS	17	22	8	0	0		50			16	
PASS	17	29	13	33	20		0			23	r=-.07
LOW PASS	17	11	26	11	60		0			18	
FAIL	50	38	52	56	20		50			44	GAMMA=-.13
N	12	43	23	9	5		2			96	

EXHIBIT 28

CROSS-CLASSIFICATION OF YEARS SINCE ENTERING THE PROGRAM BEFORE TAKING THE CORE EXAM WITH CORE EXAM SECTIONS AND FINAL SCORES

YEARS SINCE ENTERING PROGRAM BEFORE TAKING CORE

	LESS ONE %	1 %	2 %	3 %	4 %	5 %	6 %	7 %	8 %	9 %	Total %	
POLITICAL SCIENCE												
HIGH PASS	4	10	4	3	7	14	0	17		0	7	
PASS	65	36	40	42	21	14	44	17		50	39	
LOW PASS	13	31	26	32	14	14	22	50		0	27	r = -.10
LOW PASS/FAIL	0	0	0	0	7	0	0	0		50	1	
FAIL	17	24	31	24	50	57	33	17		0	27	GAMMA = -.15
N	23	140	82	38	14	7	9	6		2	321	
HISTORY												
HIGH PASS	4	12	11	8	7	14	0	17		0	10	
HIGH PASS/PASS	0	1	0	3	0	0	0	17		0	1	
PASS	52	36	34	37	36	14	11	50		50	36	r = -.06
PASS/LOW PASS	0	2	0	3	0	0	0	0		0	1	
LOW PASS	30	28	32	34	21	43	56	17		0	30	GAMMA = -.07
FAIL	13	21	23	16	36	29	33	0		50	21	
N	23	141	82	38	14	7	9	6		2	322	
SOCIOLOGY												
HIGH PASS	4	8	6	3	0	0	0	0		0	6	
PASS	22	37	34	53	0	29	22	50		0	35	r = -.12
LOW PASS	30	33	33	21	50	14	11	33		50	31	GAMMA = -.09
LOW PASS/FAIL	0	1	1	0	0	0	0	0		0	1	
FAIL	44	21	26	24	50	57	67	17		50	28	
N	23	141	82	38	14	7	9	6		2	322	
ECONOMICS												
HIGH PASS	0	5	0	0	0	0	0	0		0	2	
HIGH PASS/PASS	0	2	0	3	0	0	0	0		0	1	
PASS	13	26	23	16	21	0	0	17		0	21	r = -.20
PASS/LOW PASS	13	4	7	8	7	0	0	0		0	6	
LOW PASS	57	41	43	40	43	57	57	17		50	43	GAMMA = -.20
LOW PASS/FAIL	0	8	6	13	0	14	11	33		0	8	
FAIL	17	14	21	21	29	29	33	33		50	19	
N	23	141	82	38	14	7	9	6		2	322	
STATISTICS												
HIGH PASS	33	23	24	0	0	0	0	25		0	18	
PASS	33	25	5	13	50	50	67	0		0	20	r = -.11
LOW PASS	33	11	19	25	0	50	0	25		100	17	GAMMA = -.21
FAIL	0	42	52	63	50	0	33	50		0	45	
N	3	57	21	16	2	2	3	4		1	109	
FINAL												
HIGH PASS	0	0	1	0	0	0	0	0		0		
PASS	57	60	56	66	36	43	44	50		50		r = -.08
LOW PASS	22	17	16	8	36	14	22	17		0		GAMMA = -.08
FAIL	22	23	27	26	29	43	33	33		50		
N	23	141	82	38	14	7	9	6		2		

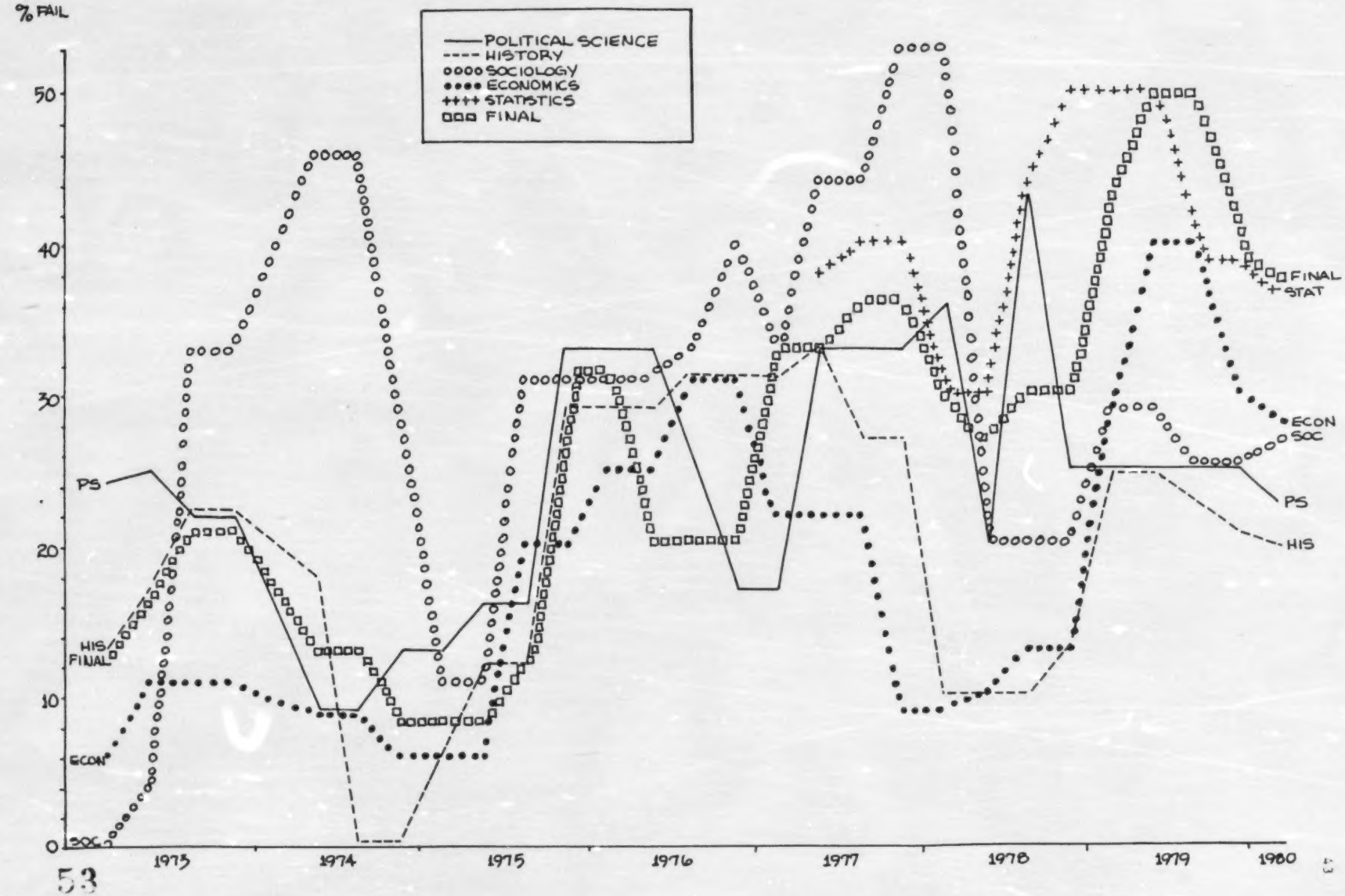
cross-classifications reveal a generally weak, but consistent trend in which the more years in the program before taking the core, the lower the section and final scores. The economics core exam section shows the strongest negative association.

The preceeding narrative has dealt with the core exam aggregated over time. It is felt that the temporal changes in the core exam are possibly reflective of a combination of factors including changes in exam procedures, differing grading approaches, and possibly a natural evolution. In Exhibit 29 the failure rates for the core exam sections and final outcome are plotted after smoothing of the data, using the method suggested by Tukey (1977, chapter 7). Through this method, running or moving medians are used. Smoothing by medians of three is done twice, resulting in a sequence that is intended to reflect overall trends rather than one-time eccentric events. It is hoped that this method reflects the substantive changes in the failure rates on the core exam.

A review of the smoothed plots indicates that over time all of the sections have had a wide range of failure rates, with Sociology evidencing the most variability. After some initial wide variabilities in failure rates, a period from 1975-1977 shows a consistent convergence of these rates, and a slight increase over time. In 1977-1978 failure rates of the sections start to diverge, with all sections except Statistics showing a downward trend. For 1979, the failure rate shows a modest increase, and also a tendency towards convergence. The overall failure rate has over time been somewhat erratic, but shows an underlying trend upward.

EXHIBIT 29

SMOOTHED TIME SERIES PLOT OF FAILURE RATES FOR THE CORE EXAM, 1973-1980.



SUMMARY AND CONCLUSIONS

The purpose of this report was to investigate the empirical associations of performance on the core examination with various scholastic and personal background variables for students in the Master of Science in Urban Life degree program. This research effort was not concerned with the rationale for, and purpose of the core curriculum. The scope of the study was confined to the internal empirical validity of the core examination. The data base consisted of those students having taken the core exam with their section scores, final letter grade in core casework, and GRE verbal and quantitative scores.

The findings of the study were presented in tabular and/or graphic format wherever possible. A brief and partial presentation of selected summary measures and coefficients are to be found in Exhibit 30. This summary table presents indicators of performance on the core examination. This analysis found that the Statistics section of the core exam was the most difficult to pass, but was also the most predictable, given course grades and GRE scores. The History section followed in predictability, though, its failure rate was relatively low. GRE scores were moderately strong in their association with core exam scores. Grades in core courses were less strongly associated, with Statistics and History course grades having the highest associations.

After statistically controlling for coursework and GRE's, it was found that: 1) age had a very weak negative association with the core exam scores; 2) male students tended to have slightly poorer performance on the core; 3) minority students tended to earn slightly lower scores on

EXHIBIT 30

SUMMARY TABLE OF SELECTED INDICATORS FOR THE CORE EXAM

CORE EXAM SECTION

	POLITICAL SCIENCE	HISTORY	SOCIOLOGY	ECONOMICS	STATISTICS	FINAL
% FAIL	27%	21%	28%	19%	45%	26%
CORRELATION WITH GRADE	.18	.33	.27	.22	.42 & .50 (II) (I)	
CORRELATION WITH GRE VERBAL	.35	.42	.32	.32	.45	.43
CORRELATION WITH GRE QUANTITATIVE	.27	.37	.25	.22	.45	.40
CORRECTLY PREDICTED FAIL SCORE	56%	71%	54%	64%	49%	88%
CORRECTLY PREDICTED SECTION SCORE	27%	32%	23%	21%	47%	78%
CORRELATION WITH FINAL SCORE	.60	.58	.50	.48	.64	

NOTE: The reader is cautioned to use these summary coefficients only after reviewing data displayed in the findings section.

the Statistics, Economics and History sections. However, minorities as a group made slightly higher final core exam scores, after controlling for performance on the individual core exam section scores; and 4) the longer the time lapse between entering the program and enrollment in a core course, the greater tendency to make lower core exam scores was displayed.

This analysis found considerable evidence that both core course grades and GRE scores were generally reliable indicators of performance on the core exam. Thus within the context of the core course procedure, the internal criterion validity of the core exam was found to be respectable. Within this context there is support for such considerations as:

1) Counseling students with low GRE's that both core courses and the core examination are likely to be substantial barriers to completion of their degree.

2) Given the differential failure rates on the core exam section, that the prospective examinee be advised of the criteria by which the exam will be graded.

In conclusion, it can be said that the core exam reasonably reflects the scholastic abilities of the M.S. in Urban Life graduate students.

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